Erosion & Sediment Control For Plan Reviewers

Instructors:

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Unit 1.

GENERAL EROSION AND SEDIMENT CONTROL PLANNING

ESC Law on Plan Review

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62.1-44.15:55 Regulated land-disturbing activities; submission and approval of erosion and sediment control plan.

- ***Sections A through G***

62.1-44.15:55-A (Approved Plan)

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- *A "reviewed and approved" plan is needed before the start of land disturbing activities*
- *Evidence of Stormwater Management program permit coverage after July 1, 2014*
- *What to do with submittal of multi-jurisdiction projects*
- *Agreement-in-lieu of a plan*

62.1-44.15:55- B (Plan Review)

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- *The Plan approving authority shall review and comment on plans within 60 days*
  - *Responsible Land Disturber (RLD) requirement*
  - *What to do if a plan is rejected*
  - *No RLD with agreements in lieu of plan*
- *If no action is taken on a plan within 45 days, the plan is considered approved as submitted.*
  - *Required to review a re-submittal within 45 days*

62.1-44.15:55-C (Changes to an Approved Plan)

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- *Explains when an approved plan may be changed:*
  1. *Inspections reveal inadequacies*
  2. *Change in circumstances during construction*

62.1-44.15:55-D (Annual Specifications)

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- *Requires annual specifications for electric, natural gas & telephone companies; pipeline companies and railroad companies.*
  - *But only for linear projects*

62.1-44.15:55-F & G (Erosion Impact Area and Ownership)

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-F

- ***Allows local programs use of "Erosion Impact Area" option to prevent erosion.***

-G

- ***Makes the owner of the land responsible for plan submittal and approval.***

Erosion and Sediment Control Planning and Review

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- Interaction between the Plan Preparer and Plan Approving Authority
- But, avoid Plan Preparation buy way of Plan Review
- Should be an integral part of the site planning process, for every project, not an afterthought
- Planning for E&S is JUST as important as any other aspect of a building project

With planning:

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- Costly E&S measures can be minimized if the site design can be adapted to the existing site conditions, and good conservation principles are used
- Use the strengths of existing site conditions to enhance E&S designs
- Keep in mind how the site will develop during construction
- Sequence installation of E&S controls properly

General Guidelines

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What is an Erosion and Sediment Control Plan?

Simply stated, an E&S Plan is a document that:

- Describes the potential for erosion and sedimentation on a construction project
- Explains and illustrates the measures to be taken to controls these problems

General Guidelines

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- An E&S Plan should be able to act as an independent document separate from working or construction drawings
- It should theoretically "stand alone" to specifically address the requirements for E&S control installation, maintenance, removal, etc.

The parts of an Erosion and Sediment Control Plan

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An E&S Plan should have two parts:

- A written portion known as the Narrative
- An illustrative portion know as the Plan.

The Planning Process

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The Narrative:

- Is the written portion that is structured to provide concise information on the project including impacts during and post construction and the proposed remedies to those impacts
- Is an important tool for the plan reviewer, inspectors and plan implementers (RLD/Site supervisor)

The Planning Process

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The Illustrative Portion or the "Plan":

- Shows the existing and proposed site conditions (clearing, grading, contours, vegetation, critical areas, drainage patterns), site development, location of practices, off-site areas, detailed drawings and maintenance requirements
- Is an important tool for the plan reviewer, inspectors and plan implementers (RLD/Site supervisor)

Plan Submittal

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Who is responsible for preparing a Plan?

- The owner or lessee of the land being developed.
- This may be delegated to an engineer, architect or contractor, but the owner retains the ultimate responsibility to ensure the plan is prepared, submitted and approved.

Plan Review

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Who is responsible for reviewing a Plan?

- The VESCP (City, County, Town, Department, Utility etc)
- The review needs to be conducted by a Certified Plan Reviewer, Certified Combined Administrator; or Licensed PE, LA, LLA, LLS, PSS

(VESCPs may contract plan review out to a third party)

The Review Process

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What is an adequate plan?

- Meets the requirements of the Minimum Standards in the Erosion and Sediment Control Regulations
- Meets more stringent requirements of local plan approving authority (if applicable).
- Contains enough information to ensure the plan approving authority that the problems of erosion and sedimentation have been adequately addressed

Plans are reviewed using:

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- Minimum Standards of the Virginia Erosion and Sediment Control Regulations
- Plan review checklist
- Specifications of the Virginia Erosion and Sediment Control Handbook (chap. 3)
- Local ordinance requirements

Plan Review Process

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62.1-44.15:55-B If no action is taken by the plan approving authority within 60/45 days, the plan is deemed approved.

Variance Procedure

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- The plan approving authority may waive or modify the Minimum Standards if deemed inappropriate or too restrictive for site conditions
- Variances should be requested at the time of plan submittal, but can be obtained during construction if conditions of the site change.
- Variance requests must be submitted in writing

Note: Variances should never be given for economic reasons

Prior to Land Disturbance

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62.1-44.15:55-B requires that as a prerequisite to engaging in the land-disturbing activities, "Certified Responsible Land Disturber" be named who will be in charge of and responsible for carrying out the land disturbing activity

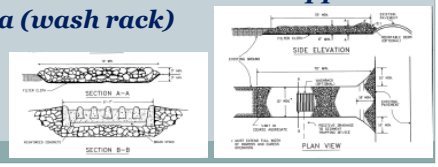
Note: The program authority has the option to waive the RLD requirement for an Agreement in Lieu of Plan for construction of a single family residence provided no violations occur.

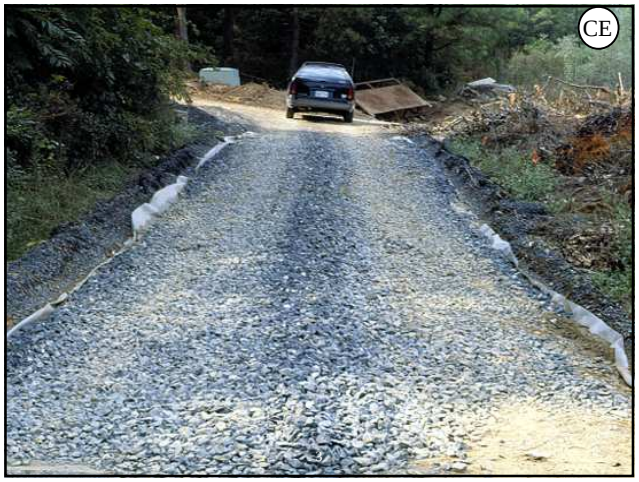
Plan Reviewer Class Structural Controls

Construction Entrance - 3.02 (CE)

Applies <u>whenever</u> traffic leaves a constructions site onto a public or paved road

- ***VDOT #1 aggregate (2-3" stone)***
- ***6" thick - 12' wide 70' long***
- ***Wash water must be carried to an approved settling area (wash rack)***
- ***Filter cloth***



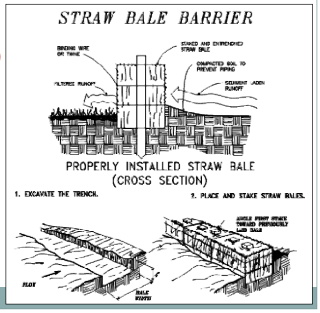


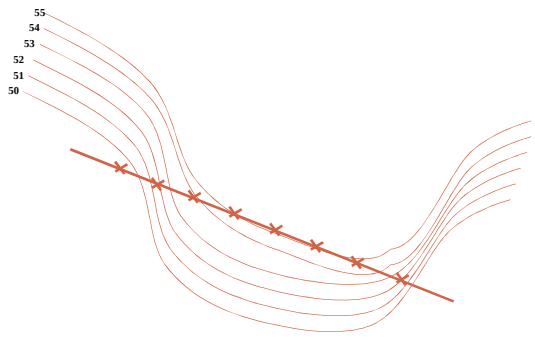
Maintenance (MS-17)

- *Mud shall be removed at the end of the day.*
- *Cleaning of pavement shall be done by shoveling and sweeping*
- *Wash ONLY after shoveling and sweeping*

Straw Bale Barrier - 3.04 (STB)

- *Maximum drainage area 10,000 square feet per 100 feet length (= 100x100 ft)*
  - *Placed in a single row, lengthwise on the contour*
- *For sheet flow only*





Incorrect placement of Sediment Barrier … Needs to be on contour!

Planning Considerations

- *Expensive*
- *Inspection & Maintenance*
  - *Inspection immediately after each rainfall*
  - *Repair if damaged and end runs and undercutting*
  - *Remove sediment after each rainfall*
  - *Remove at one-half the barrier*
- *Remove (MS18) and dress slope to grade (large undisturbed area)*

Silt Fence - 3.05 (SF)

- *Maximum drainage area 10,000 square feet per 100 feet length (= 100x100 ft)*
  - *Placed in a single row, lengthwise on the contour*
- *Approved for small quantities of channel flow (<1 acre and <1 cfs)*
- *Do not use in rocky areas or areas with shallow soil*
- *Best placed 5 to 7 feet beyond the base of a disturbed slope*

Silt Fence - 3.05 (SF)

- *Oak stakes 2" diameter - max 6' apart*
- *Pine stakes 4" diameter - max 6' apart*

Installation

- *Fabric not stapled to trees*
- *If constructed across a ditch it should be sufficient length - no endflow*
- *Backfill trench*

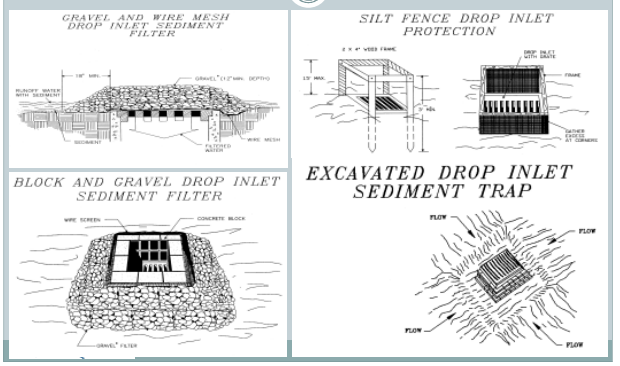
Maintenance

- *Inspected after each rainfall*
- *Daily with prolonged rainfall*
- *Repair immediately*
- *Look for undercutting and end runs*
- *Sediment deposits should be removed after each storm and must remove at 1/2 barrier height*
- *Remove when no longer needed (MS-18)*

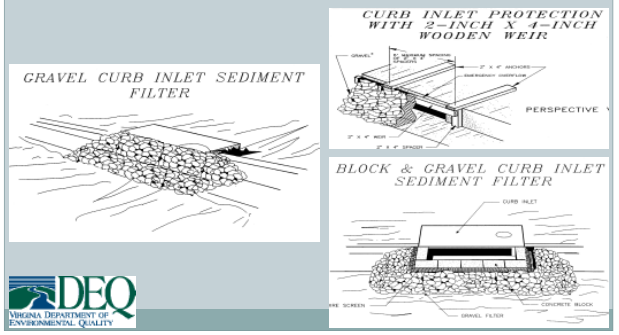
Storm Drain Inlet Protection - 3.07 (IP)

- *To be used when storm drain inlets are to be made operational before permanent stabilization*
- *Needs careful planning → some measures should not be used under certain (traffic/construction) situations*
- *Maximum drainage area of 1 acre*
- *Silt fence more efficient*
- *Stabilize upslope area as soon as possible*

Storm Drain Inlet Protection - 3.07 (IP)

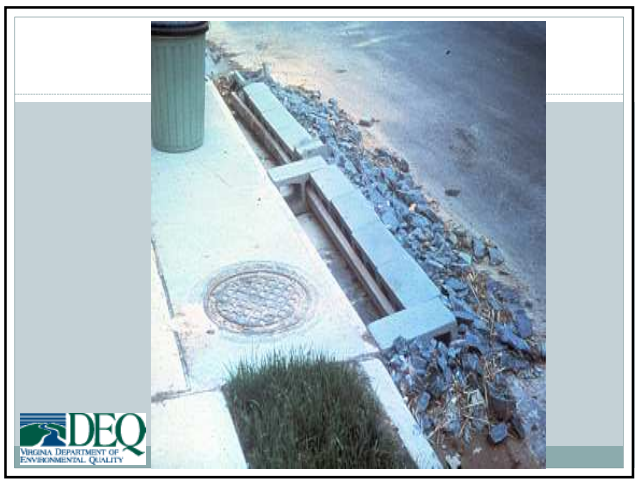


Storm Drain Inlet Protection - 3.07 (IP)

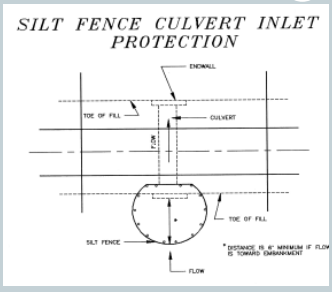


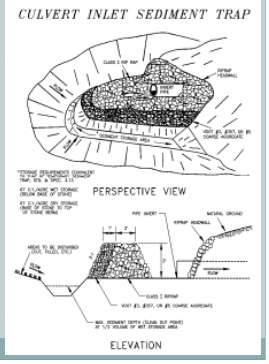
Storm Drain Inlet Protection - 3.07 (IP)

- *Consider traffic through the area with design*
- *Consider (ponding) impacts on surrounding areas*
- *Consider cleanout*
- *Stone filters may be completely wrapped in wire mash*



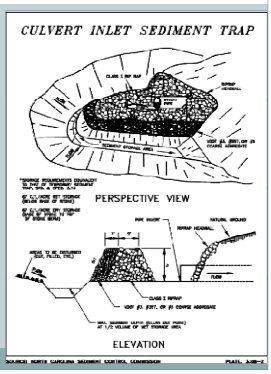
Culvert Inlet Protection - 3.08 (CIP)





Inlet Sediment Trap

- *Horseshoe shaped*
- *Toe of riprap no closer than 24" from opening*
- *Substitute for sediment trap*
- *Storage requirements the same as the sediment trap*



Silt fence culvert inlet

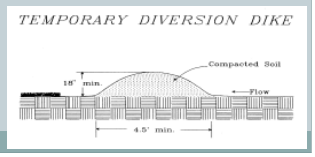
- *Extra strength filter fabric-stakes 3' apart*
- *Silt fence placed 6' from culvert in the direction of flow-horseshoe*
- *Stone combination-strong flows*

Maintenance

- *Inspected after each rain*
- *Aggregate replaced or cleaned if clogged*
- *Sediment has reached 1/2 storage area for cleanout*
- *Remove temporary structures*

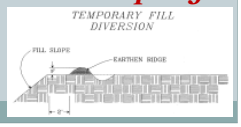
Temporary Diversion Dike - 3.09 (DD)

- *Maximum drainage area = 5 acres*
- *Positive grade channel behind dike*
- *Outlet must discharge into a receiving channel*
- *Installed as the first step (MS-4)*
- *Compacted & seeded immediately after construction (MS-5)*



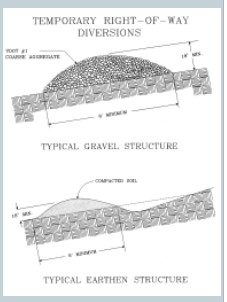
Temporary Fill Diversion - 3.10 (FD)

- *Temporary - will be replaced the next day*
- *If longer, need to inspect each day*
- *Positive grade to outlet*
- *Released into stabilized drain*
- *Constructed at the top of a fill at the end of each work day as needed*
- *Located at least two feet inside the top edge of the fill*



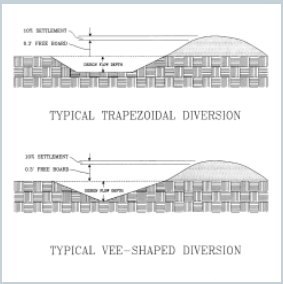
Right-of-Way Diversion - 3.11 (RWD)

- *Used to shorten the flow length within a sloping right-of-way*
- *Use earthen structures where there is little traffic, gravel with high traffic*
- *See Table 3.11-A for spacing requirements*
- *Outlet in undisturbed area*



Diversion - 3.12 (DV)

- *Permanent*
- *Reduced slope length (think critical slope)*
- *May divert flow from critical area*
- *Prevent damage from runoff*
- *Reduced drainage area size*



Diversion - 3.12 (DV)

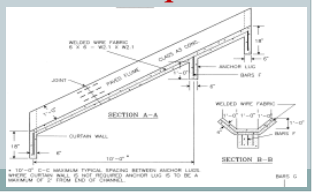
- *Require a channel that meets proper channel design (10 year storm)*
- *Need outlet protection*
- *Stabilized before making operational*

Temporary Slope Drain - 3.15 (TSD)

- *Used on cut or fill slopes to prevent erosion from upslope flows*
- *Maximum drainage area = 5acres*
- *Slope drain entrance slopes 1/2" per foot*
- *Be secured - staked*
- *Install culvert inlet and outlet protection*

Paved Flume - 3.16 (PF)

- *Permanent*
- *Conducts stormwater runoff safely down the face of a slope (when riprap is insufficient)*
- *Man-made channel (10-year storm)*
- *Need energy dissipator and outlet protection*
- *VDOT Specifications*

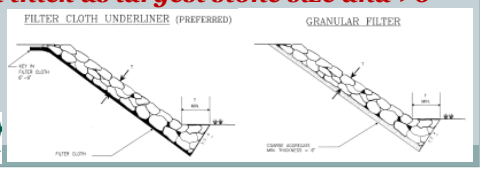


Riprap - 3.19 (RR)

- *Protect channels and slopes from erosive forces*
- *Slow down concentrated runoff to allow infiltration*
- *Protects unstable slopes and slopes with seepage problems*
- *Very little maintenance*

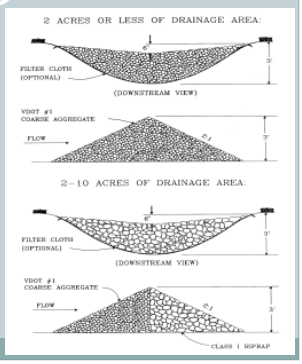
Riprap - 3.19 (RR)

- *Size and weight must correspond to specs.*
- *Some filter underlining (filter cloth or granular)*
- *Placed to produce a well graded mass with a minimum of voids*
- *Twice a thick as largest stone size and >6”*



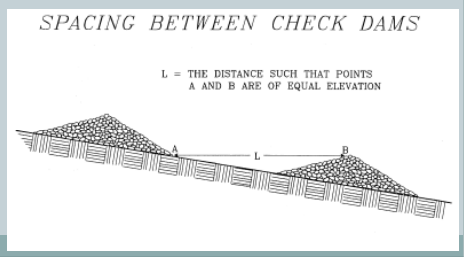
Rock Check Dam - 3.20 (CD)

- *Reduce velocity of concentrated flow*
- *Limited to 2 acres drainage with VDOT #1 coarse aggregate*
- *Limited to 10 acres with Class I riprap and VDOT #1*



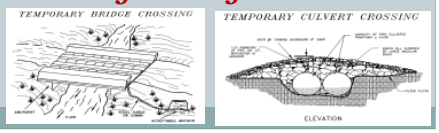
Rock Check Dam - 3.20 (CD)

- *Spacing - the upstream toe same elevation as top of downstream*



Temporary Vehicular Crossing - 3.24 (SC)

- *MS-13*
- *Cross streambed without damaging bed and banks*
- *Maximum drainage area 1 square mile*
- *Keep disturbance to bed and banks cleared to a minimum*
- *Non-erodible decking & stringers*

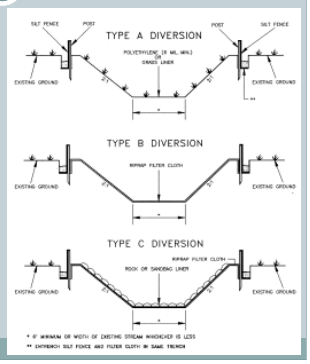


Temporary Vehicular Crossing

- *12 to 20 ft wide road bed*
- *50 foot buffer*
- *Culvert crossing needs to convey a 2 year storm when in place <14 days and a 10 year storm if in place 14 days to 1 year*

Utility Stream Crossing - 3.25 (USC)

- *Minimizes disturbance in stream*
- *< 1 square mile*
- *If >1 suqare mile need detailed design*
- *Three types (A, B or C) depending on the bankful velocity*



De-watering Structure - 3.26 (DS)

- *Filter sediment before it is discharged*
- *Part of a pumping operation*
- *Steel drums, wood, other*
- *Pump discharge (gpm) x 16 = cubic feet of storage required*
- *Emergency over flow*

Temporary Sediment Trap - 3.13 (ST)

- ***Detains sediment-laden runoff from small disturbed areas long enough to let sediment settle out (MS-6)***
- ***Drainage areas <3 acre (134 CY/Acre)***
- ***½ wet, ½ dry storage***
- ***Detention time approximately 6 hours ←→ outlet size***

Applicable Minimum Standards

MS-4
- Needs to be constructed as a first step measure
- Needs to be made functional before upslope land disturbance

MS-5
- Stabilization measures must be applied to earthen structures immediately after installation

MS-6
- Must be designed and constructed based upon the total drainage area to be served
- Minimum storage capacity = 134 cubic yards per acre of drainage area
- Shall only control drainage areas less than three acres

Applicable Minimum Standards

MS-8
- Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume or slope drain structure

MS-10
- May need to have inlet protection

MS-11
- Needs to have outlet protection

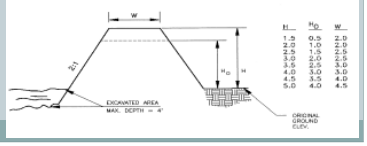
MS-18
- Needs to be removed at the end of the project

MS-19
- Needs to discharge into an adequate channel

Sediment Trap - Embankment

- *Wet storage in excavated area (preferred)*
- *Embankment- Max. height 5'- from the base of the stone outlet*

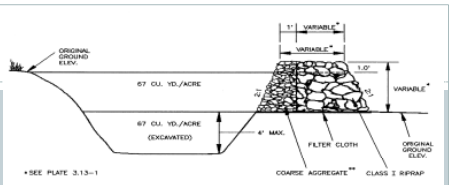
MINIMUM TOP WIDTH (W) REQUIRED FOR SEDIMENT TRAP EMBANKMENTS ACCORDING TO HEIGHT OF EMBANKMENT (FEET)



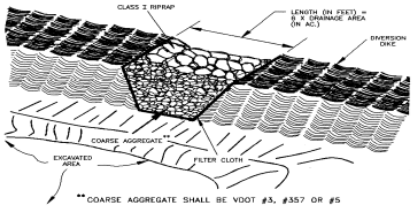
H	H_D	W
1.5	0.5	2.0
2.0	1.0	2.0
2.5	1.5	2.5
3.0	2.0	2.5
3.5	2.5	3.0
4.0	3.0	3.0
4.5	3.5	4.0
5.0	4.0	4.5

Temporary Sediment Trap - Outlet

- *Outlet- Stone section of the embankment located at the low point in the basin ➔ outlet protection*
- *Combination of aggregate and riprap provide for the filtering and detention & outlet stability*
- *Min. length of outlet is 6 feet times the # of acres of drainage to the trap*
- *Crest of the stone outlet be at least 1 foot below the top of the embankment*



CROSS SECTION OF OUTLET



OUTLET (PERSPECTIVE VIEW)

Temporary Sediment Basin - 3.14 (SB)

- ***Detains sediment-laden runoff from disturbed areas long enough to let sediment settle out (MS-6)***
- ***Drainage areas >3 acre (134 CY/Acre)***
- ***½ wet, ½ dry storage***
- ***Detention time approximately 6 hours ←→ outlet size***

Applicable Minimum Standards

MS-4
- Needs to be constructed as a first step measure
- Needs to be made functional before upslope land disturbance

MS-5
- Stabilization measures must be applied to earthen structures immediately after installation

MS-6
- Must be designed and constructed based upon the total drainage area to be served
- Minimum storage capacity = 134 cubic yards per acre of drainage area
- Shall control drainage areas that are three acres or larger

Applicable Minimum Standards

MS-8
- Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume or slope drain structure

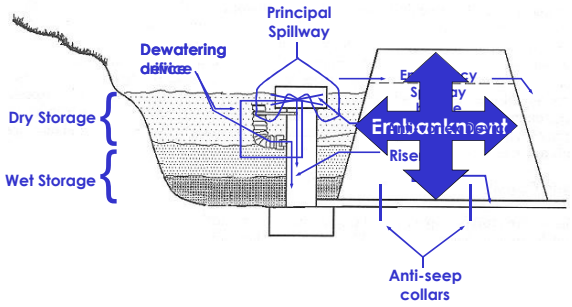
MS-10
- May need to have inlet protection

MS-11
- Needs to have outlet protection

MS-18
- Needs to be removed at the end of the project

MS-19
- Needs to discharge into an adequate channel

Temporary Sediment Basin



Temporary Sediment Basin

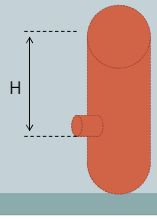
- *Generally located at the hydrologically lowest point of the project*
- *Basin area cleared of all organic materials*
- *May be converted into a stormwater basin after the project is completed (different outfall and maybe different configuration)*

Sediment Basin

- *Embankments- (III-80)*
- *<10' tall - It must have a min. top <u>width</u> of 6' and 2:1 side slopes or flatter*
- *10-14' tall the min. top <u>width</u> shall be 8 feet and side slopes 2 1/2 : 1 or flatter*
- *15' tall -the top <u>width</u> must be 10' with slopes 2 1/2 : 1*
- *Clean fill material-20% clay*

Dewatering orifice

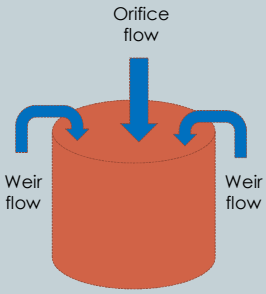
- The orifice is the principal spillway for the basin
- Draw down from the top of the riser to the bottom of the orifice should be 6 hours
- Draw down a function of orifice size and average driving head



H= Maximum head
h= Average driving head
h=H/2

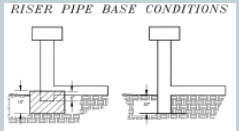
Riser

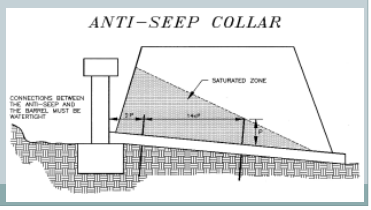
- Two types of flow:
  1. Weir Flow
  2. Orifice flow



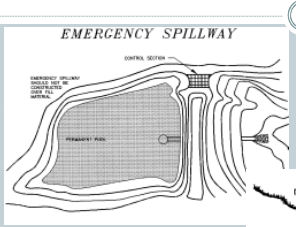
Anchors and Anti Seep Collars

- ***Barrel and riser firmly anchored***
- ***BASE- Anchored to prevent floating***
- ***Anti seep collars***

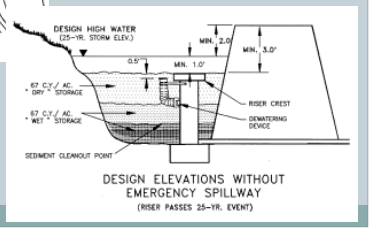


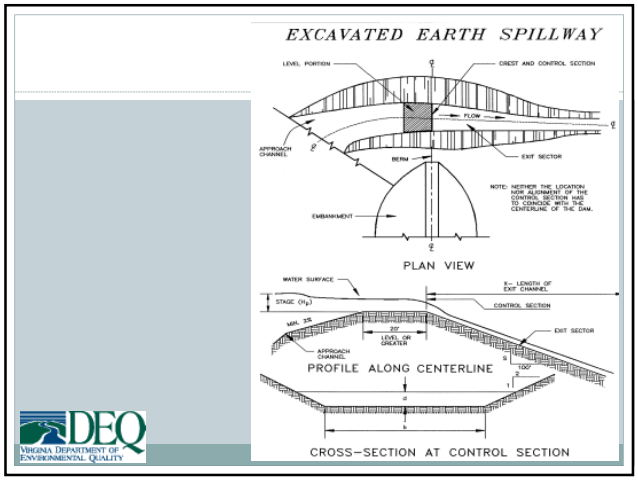


2 types of Emergency Spillways



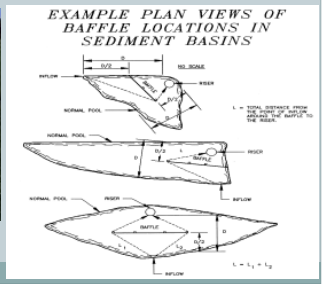
- In an undisturbed area
- Or designed to a 25 year storm

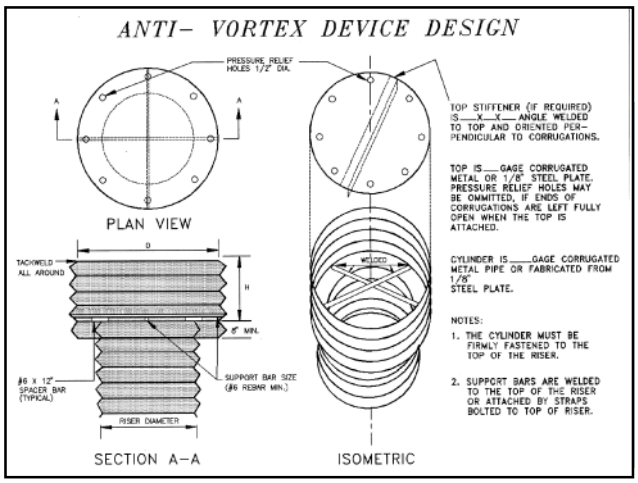




Baffles

- ***Basin shape 2:1 - baffles***
- ***Safety- Warning signs should be installed***




ANTI– VORTEX DEVICE DESIGN
PRESSURE RELIEF HOLES 1/2" DIA.
A
A
PLAN VIEW
D
TACKWELD ALL AROUND
H
6" MIN.
#6 X 12" SPACER BAR (TYPICAL)
SUPPORT BAR SIZE (#6 REBAR MIN.)
RISER DIAMETER
SECTION A–A
WELDED
ISOMETRIC
TOP STIFFENER (IF REQUIRED) IS ___X___X___ ANGLE WELDED TO TOP AND ORIENTED PERPENDICULAR TO CORRUGATIONS.
TOP IS ___GAGE CORRUGATED METAL OR 1/8" STEEL PLATE. PRESSURE RELIEF HOLES MAY BE OMMITTED, IF ENDS OF CORRUGATIONS ARE LEFT FULLY OPEN WHEN THE TOP IS ATTACHED.
CYLINDER IS ___GAGE CORRUGATED METAL PIPE OR FABRICATED FROM 1/8" STEEL PLATE.
NOTES:
1. THE CYLINDER MUST BE FIRMLY FASTENED TO THE TOP OF THE RISER.
2. SUPPORT BARS ARE WELDED TO THE TOP OF THE RISER OR ATTACHED BY STRAPS BOLTED TO TOP OF RISER.

Outlet Protection – 3.18 (OP)


Outlet Protection-3.18

- *MS-11*
- *Prevent scour*
- *Protect outlet*
- *Slow velocity of water/energy*

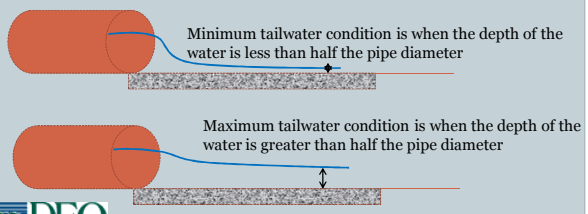
Outlet Protection-3.18

- *Dimensions specified on plan*
- *Apron constructed with no slope along its length- 0% grade*
- *No outfall at end of apron*
- *Discharged into well defined channel (MS-19)*
- *No bends*


Tailwater depth

Tailwater =the water directly below the outfall

1. Minimum tailwater conditions
2. Maximum tailwater conditions



Unit VI. Erosion and Sediment Control (ESC) Narrative

Why is a narrative important?

- A written statement which explains the ESC decisions made and the justification for those decisions.
- Contains- Concise information concerning existing conditions, construction schedules - for the plan reviewer
- Provides the superintendent and inspector a single descriptive ESC report

ESC Narrative Components 1. Minimum Standards 1 - 19

Requirements: All applicable Minimum Standards must be addressed

- Provide guidance and authority
- Must be satisfied - Variance
- Separate check list

2. Project Description

Requirements: Briefly describe the nature and purpose of the land-disturbing activity, and the area (acres) to be disturbed

- Ensure adequate controls
- Stormwater management
- Ultimate build
- List area in acres
- Disturbed acreage database

3. Existing Site Conditions

Requirements: A description of the existing topography, vegetation and drainage

- Ground cover most important
- Save existing - staging construction
- Shield bare soil
- Existing vegetation type
- Site visit
- Check designed controls to topography

4. Adjacent Areas

Requirements: A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance

- Off-site damage
- Increased stormwater
- Environmentally sensitive areas
- Verify adequate perimeter controls

5. Off-Site Areas

Describe any off-site land-disturbing activities that will occur (including borrow sites, stockpiles, etc.)

- Compare existing contours with final contours
- Off-site E&S plan
- If no off-site disturbance exist a statement to that effect should be included

6. Soils

Requirement: A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture and soil structure

- Detected problem later - delays - increased costs
- Soil surveys
- Determine soil stability

7. Critical Areas

Requirements: A description of areas on the site which have potentially serious problems (steep slopes, channels, wet weather/underground springs, etc.)

- Designed appropriate controls
- Let everyone know the high priority areas

8. Erosion and Sediment Control Measures

Requirements: A description of the methods which will be used to control erosion and sedimentation on the site. Chapter III VESCHB

- Required ESC
- Why selected
- VA uniform code & Standard and Spec. #
- Description of sequence of construction

9. Permanent Stabilization

Requirement: A brief description, including specifications, of how the site will be stabilized after construction is completed

- Permanent cover on denuded areas
- Permanent stabilization uniform, mature to survive
- How stabilized after completion
- Specific seed mixes, soil amendments, cover

10. Stormwater Runoff Considerations

Requirements: Will the development site cause an increase in peak runoff rates? Will the increase in runoff cause flooding or channel degradation downstream? Describe the strategy used to control SW runoff

- Prevent erosion damage to downstream properties or waterways
- Potential runoff, channel adequacy and SWM practices

11. Calculations

Requirements: Detailed calculations for the design of temporary sediment basins, permanent SW detention basins, diversions, channels, etc. Include calculations for pre- and post-development runoff

- Detailed description for controlling runoff
- Pre- and Post-development for each drainage area - all calculations

12. Maintenance

Requirement: A schedule of regular inspections and repair of E&SC structure should be set forth

- Regular maintenance schedule
- Named person responsible
- Permanent measure responsibility
- Inspection schedule

Unit III
ESC Site Plan

- Maps or drawing that depict information in narrative
- Implement - install - maintain
- The "blue print"
- VESCH Chapter III contains standard and specifications
- Standard numbering and coding system

1. Vicinity Map

Requirements: A small map locating the site in relation to the surrounding area. Include any landmarks which might assist in locating the site

- Small map to locate
- Repo of topo maps and county road maps
- Good to identify off site sensitive areas

2. Indicate North

Requirements: The direction of north in relation to the site.

- Provide orientation of site
- Direction is good for planning purposes
- Slope orientations

3. Limits of Clearing and Grading

Requirements: Areas which are to be cleared and graded

- Limits of construction is the first step to determine ESC measures
- To verify plan compliance
- Avoid complaints
- Should be physically marked

4. Existing Contours

Requirements: The existing contours of the site

- Represent the pre-development conditions
- To check drainage divides and patterns
- Potential critical areas
- 1 to 5 foot intervals
- Determine cuts and fills
- If ESC measures have been designed properly

5.Final Contours

Requirements: Changes to the existing contours, including final drainage patterns

- Post-development drainage patterns
- Adversely affected, adequate channels
- Cut and fill information on slopes
- Steep slopes can become a problem

6. Existing Vegetation

Requirements: the existing tree lines, grassed areas, or unique vegetation

- Preserve green spaces
- Buffer zones in sensitive areas
- Used to verify tree protection

7. Soils

Requirements: the boundaries of different soil types

- Types, conditions, topography
- Depth to bedrock, depth to seasonal water table, permeability, shrink-swell potential, texture
- Highly erodible soils

8. Existing Drainage Patterns

Requirements: The dividing lines and direction of flow for the different drainage areas. Include the size (acreage) of each drainage area

- Most essential
- Structural controls are based on this
- Location based on flow path
- Avoid critical flows and utilize existing drainage

9. Critical Erosion Areas

Requirements: Areas with potentially serious erosion problems (Chapt. VI)

- Prevent degradation to live streams, sediment loss and safety hazards
- Steep slopes, ponds, long slopes, natural watercourses, lakes and ponds
- Confine to least critical

10. Site Development

Requirements: Show all improvements, such as buildings, parking lots, access roads, utility construction, etc.

- SWM ultimate development
- Careful planning for placement of utilities and buildings
- Cluster concept

11. Location of Practices

Requirements: The location of ESC and SWM practices used on site